

# Can we reconstruct past terrestrial ecosystem Si budgets?

*A consideration of the plants of the Carboniferous Period (358.9 Mya to 298.9 Mya) of the Paleozoic Era*

Dr Julia Cooke



Extant ferns (few eggs) have comparatively high Si, bryophytes (better studied) lower<sup>8,9</sup>

Evidence of plant defence (trichomes etc)<sup>6</sup>

Key species physiologies and growth forms likely very different to modern vegetation forests<sup>10,11</sup>

Key plants capable of growth and transpiration rates much higher than extant relatives<sup>10,11</sup>

**BSi Plant storage (& function)**

Tree-like plants relatively short lived, 10-15 years and possibly faster decomposition.<sup>5</sup>

Limited branching in taller plants meant less shading<sup>5</sup>

Whole plant hydraulic calculations possible, presence of identified and unidentified transporters predicted<sup>9,10,11</sup>

Abundant phytophagous insects (sap feeding, leaf cutting, seed boring, detritivores) and latterly also reptiles and other tetrapods<sup>2,7,10</sup>

Both wet and dry tropical forests, likely to impact cycling differentially<sup>10</sup>

Massive coal deposits formed during this period. Very poor preservation of phytoliths in coal, likely due to silicate neoformation during later diagenetic processes<sup>11,12</sup>

Estimates of GPP vary across Pangea, but while most are lower than present, some are similar to the present<sup>1</sup>

Evidence of terrestrial plants impacting weathering, and Si export into marine systems<sup>3,4</sup>

Vegetation dominated by now extinct lineages of early-diverging vascular plants (eg tree-sized lycophytes)<sup>10</sup>

**DSi uptake by plants**

**BSi loss by herbivory, litterfall, plant death**

**DSi in soil**

**BSi in soil**

## Taken together:

- Multiple aspects point towards large amounts of Si cycling
- Care needed inferring plant Si uptake and use from extant relatives
- DSi availability and weathering rates key given likely, high water uptake

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## Example references

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